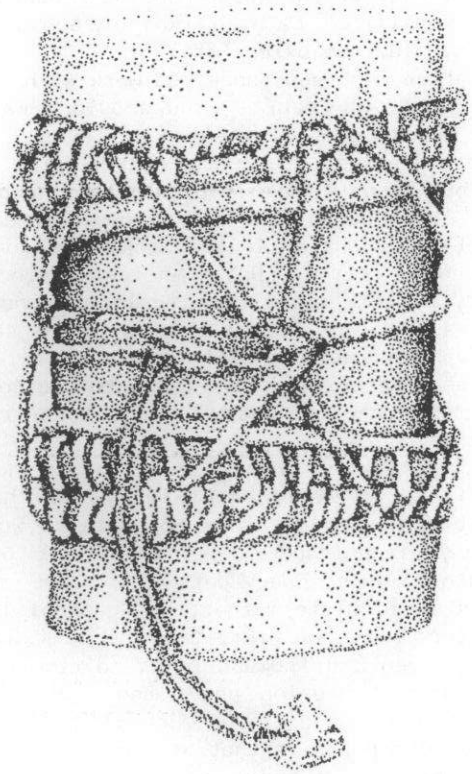
VOLUME IV NUMBER 4 DECEMBER 1988 PRICE 3.50

FOR THE DESIGN, CONSTRUCTION AND ENJOYMENT OF NEW SOUND SOURCES

EXPERIMENTAL MUSICAL INSTRUMENTS



SOUND FROM STRETCHED MEMBRANES

Some opening thoughts from the editor

This issue of EMI features two articles on a topic that has in the past been somewhat neglected in these pages. The subject is musical membranes. The articles are on two types of drum and drumhead -- one Eastern and one, if not really Western in origin, at least by now very familiar to Western musicians. In "Congas According to Carraway," starting on page 9, we follow the procedures of Conga maker Jim Carraway in preparing and applying the head for one of the most prominent, but least studied, instruments of our day. In "The Tabla Puddi," starting on page 12, David Courtney describes the Indian tabla and the extraordinary methods of preparation of the drumhead that make for its unique acoustic properties.

IN THIS ISSUE

In introducing these two articles I have not yet used the word "membranophone," although they are indeed about membranophones. The reason is that I want to take the opportunity to present a very broad view of the subject of sounding membranes. "Membranophone," as used by those who coined the term, refers to instruments whose initial source of vibration is a stretched membrane. But stretched membranes of various sorts can serve many secondary purposes in musical instruments, as (for instance) sound transmitters and radiators, sound modifiers, vibrational insulators, air reservoirs and blowers, storehouses of potential pneumatic energy, and labial "reeds" that convert a steady air stream into audible

Continued on page 8

Above right: Small drum from British Guyana.
Drawing by Robin Goodfellow.

LETTERS

[The following letter responds to the statement "Oils and sawdust are organic ... and pose little hazard," from the article "Sonorous Metals for the Experimenter" in EMI's last issue.]

It is a common misconception that organic dusts and fumes are not harmful. Most tropical woods are either toxic or allergenic to the skin as well as to the lungs, and many common soft woods like cedar and redwood are toxic when inhaled as small particles. Turpentine fumes, although organic, are not safe to inhale, and many oil finishes contain turpentine and other solvents. In addition, the abrasives used to coat sandpaper are generally made of the worst possible substances to inhale -- silicon carbide (which causes silicosis), and aluminum oxide, etc.

No matter what substance you work with -- wood, metal, glass, whatever -- you should always take proper precautions. Protect your eyes with unbreakable glasses, your ears with hearing protectors, your lungs with a respirator and good ventilation, and your hands with common sense. Keep them both in sight while you work, and never work when you're tired. Use the same precautions whether you work with power tools or hand tools. It is easy to be lulled into a false sense of security when working with hand tools, and a friend who recently cut his thumb to the bone with a chisel learned the hard way not to be cavalier about edge tools.

Let me take a moment here to second Susan Rawcliffe's statements about PVC pipe. There are some substances which it is not safe to work with under any circumstances, and PVC is one of them. Respirators, even heavy-duty ones, are made to keep out particulate matter, not gasses. The best respirators will not protect you from fumes given off by solvents or combustion, and combustion is unavoidable when using power tools on plastics. Leave PVC alone, and if you must use plastics, try to stick with plastics that are safer.

The lecture ends here.

Debbie Suran

About two years ago, I heard a street musician in Boston/Cambridge (possibly the latter) who played a homemade "orchestral" instrument called

THE MAJESTIC BELLO-PHONE,

constructed of tubes, funnels, pieces of scrap band instruments, hoses, playground balls, and percussion objects. The repertoire was light classical.

I don't know his name, but his work certainly deserves publication in your magazine.

Paul Clinco

[Anyone with information on the Bello-phone is encouraged to contact EMI at our regular address. If we get a lead, perhaps we'll be able to follow this up with a future report on the instrument. -- ed.]

[The following letter refers to the writer's article "Our Great Spherical Friend, Part V: An Experimental Bass," which appeared recently in American Lutherie and was noted subsequently in EMI's "Recent Articles in Other Periodicals" section.]

I think your magazine is wonderful and full of great ideas and information. It's wonderful that all this stuff is happening!

Thanks for reviewing my article in American Lutherie #14. My instrument worked OK on an experimental level, but I know from experience that bass players are very fussy, that playing with a traditional technique even on a good bass

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involves a great many problems and obstacles; they don't need any more. Therefore I didn't want anybody to think that this was a really playable fiddle -- it's too heavy and clumsy.

I still hope to work out the design with lighter materials in a more manageable shape.

Fred Lyman

NOTES FROM RECENT CORRESPONDENCE

In connection with recent letters to EMI on the subject of potential health hazards associated with instrument building materials, Barbara Robben has drawn our attention to **Art Hazard News**. **Art Hazard News** is an 8-page newsletter covering hazards, precautions, government regulations and other topics related to hazards in the visual arts, performing arts, museums and school art programs. A couple of items appearing in the current issue are of potential interest to EMI readers. One is a report on the Sixth Annual Symposium on the Medical Problems of Musicians and Dancers, addressing, among other topics, musculoskeletal problems in instrumentalists. The other is a call from the Center for Safety in the Arts (address same as the newsletter address below) for information on devices such as padding, straps and instrument modifications serving as ergonomic aids for musical instrument players.

Art Hazard News appears 10 times a year. Subscriptions are $15 from Art Hazard News, 5 Beekman St., Suite 1030, New York, NY 10038.

A.R.C. Publications is back! In the early seventies the Aesthetic Research Center of Canada published a number of books on various subjects about which it is usually difficult to find anything written at all, among them several of Murray Schafer's soundscapes series, and John Grayson's sound sculpture books and record. As a small independent press, A.R.C. never achieved mass distribution, and when the press ceased doing business some years ago, its books became like unicorns, much discussed but seldom seen. New owners have now taken over the company, and the long unavailable titles are now available again. Write for information to A.R.C. Publications, PO Box 711, Duncan, BC, V9L 3Y1, CANADA. Thanks to Bill Jaeger for passing the information along.

Readers often send in copies of articles from other publications that merit mention in the "Recent Articles" section that appears on the back cover of each issue of **Experimental Musical Instruments**. This has been quite valuable and the editor encourages everyone to keep it up. If you do send something in, be sure to include the name, address and issue date of the publication so we can include those things in our write up.

EMI BACK ISSUES

The original press runs of most of EMI's early issues began selling out a year or two ago. Since that time we have continued to make those issues individually available in photocopy. That practice has proven impractical, and we will now be taking another approach.

From now on, back issues from EMI's first two years of publication will no longer be available individually, but instead in two volume sets, each bound under a single cover. The issues contained in these volumes are reproduced exactly as they originally appeared, but in photocopy. The price per volume is remains at $14, discounted from $20 to reflect people's preference for the original print run. The two cassette tapes containing music of instruments which appeared in those two volumes remain available separately as always.

Here's the complete information:

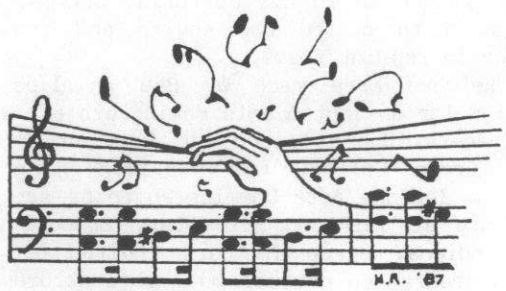
Experimental Musical Instruments Volume I contains issues numbered Volume I #1 - 6 (June 1985-April 1986) in photocopy. Price $14

Experimental Musical Instruments Volume II contains issues numbered Volume II #1 - 6 (June 1986-April 1987). Price $14.

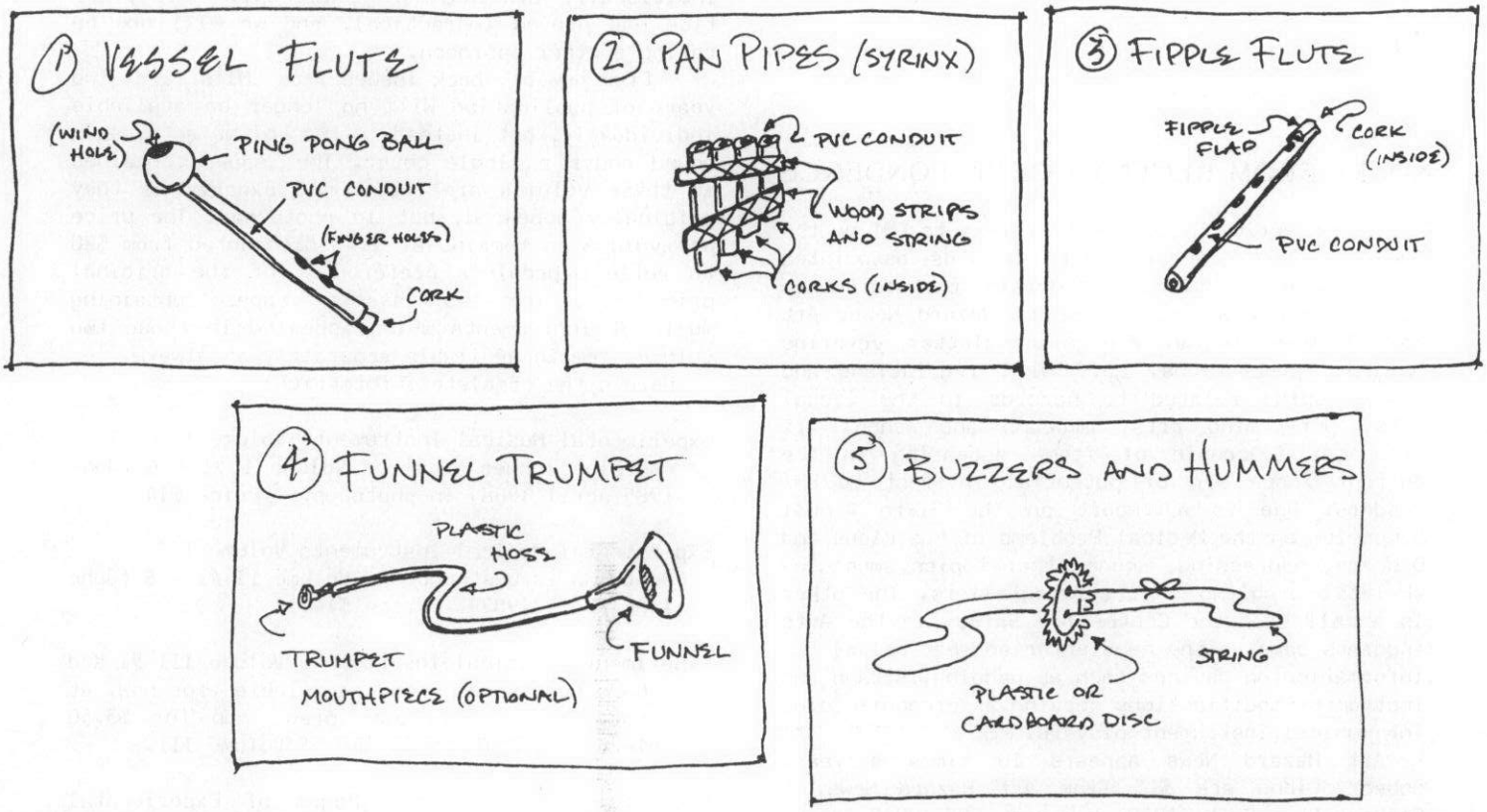
Experimental Musical Instruments Volume III #1 and subsequent issues remain available (for now, at least) in the original press run for $3.50 apiece or $20 the 6 issues of Volume III.

Cassette Tapes **From the Pages of Experimental Musical Instruments** Volumes I, II and III, each containing music of instruments appearing in the corresponding volume of the printed newsletter, remain available at $6 per cassette for subscribers; $8.50 for others.

Why have we gone to all this effort and expense to keep the back issues available? Because the material they contain is not the sort of stuff that becomes outdated. The musical instrument ideas, designs and commentary remain and will continue to remain valuable to anyone interested in the subject.



Drawing by Hal Rammel



I. AEROPHONES

A CHILDREN'S INSTRUMENTS WORKSHOP

Instrument designs by Bob Phillips

From the editor:

EMI's readers often express an interest in musical instrument explorations in the classroom. I thought of that when the sketches on the following pages turned up in our editorial office, and was prompted to go to the source and request permission to reprint them.

The sketches were made by Bob Phillips in preparation for an instruments making project with fourth graders. Bob's friend and frequent collaborator, Gregg Coffey, had received a grant through the Indiana Arts Commission to be artist-in-residence at Yorktown Elementary School near Muncie, Indiana. Gregg in turn invited Bob to develop a program on unusual musical instruments. The resulting workshops comprised four sessions with each class, led jointly by Bob and Gregg.

In the first session, the students were given some background on the sorts of instruments they would be working with. Bob and Gregg brought in books with pictures and descriptive texts, along with a number of instruments for demonstrations. The emphasis was on "panethnic" instruments, to introduce the students to non-European music makers. The selection was also designed to provide an overview of the different families of musical instruments.

In the second session, it was decided which students would work with which instrument types, chosen from among designs that Bob had prepared. They made colored drawings of their finished instruments as they envisioned them. With these relatively young students, the actual construction work on the part of the students was kept to a minimum; their contributions to the instruments

Continued on page 6

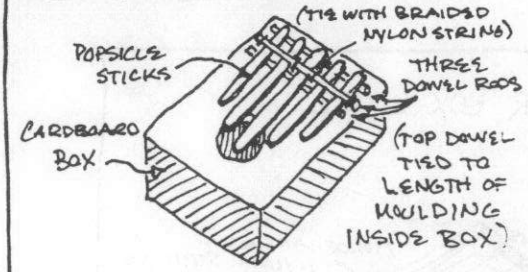
① WATER VESSELS

- METAL, CERAMIC OR GLASS:
  - BOWLS
  - CUPS OR TUMBLERS
- CHOPSTICKS
- WATER

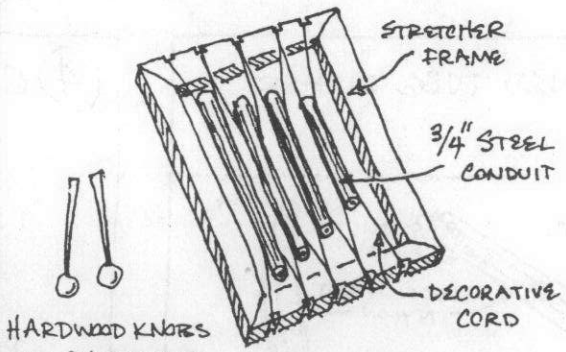
② WATER GONG

- PAN LID
- BUCKET
- CHOPSTICK
- WATER

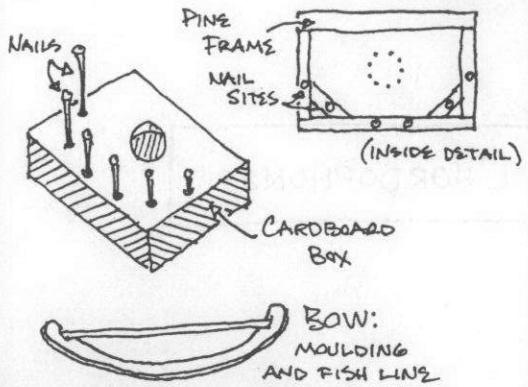
③ KALIMBA



④ CONDUIT TUBULONG



⑤ NAIL VIOLIN

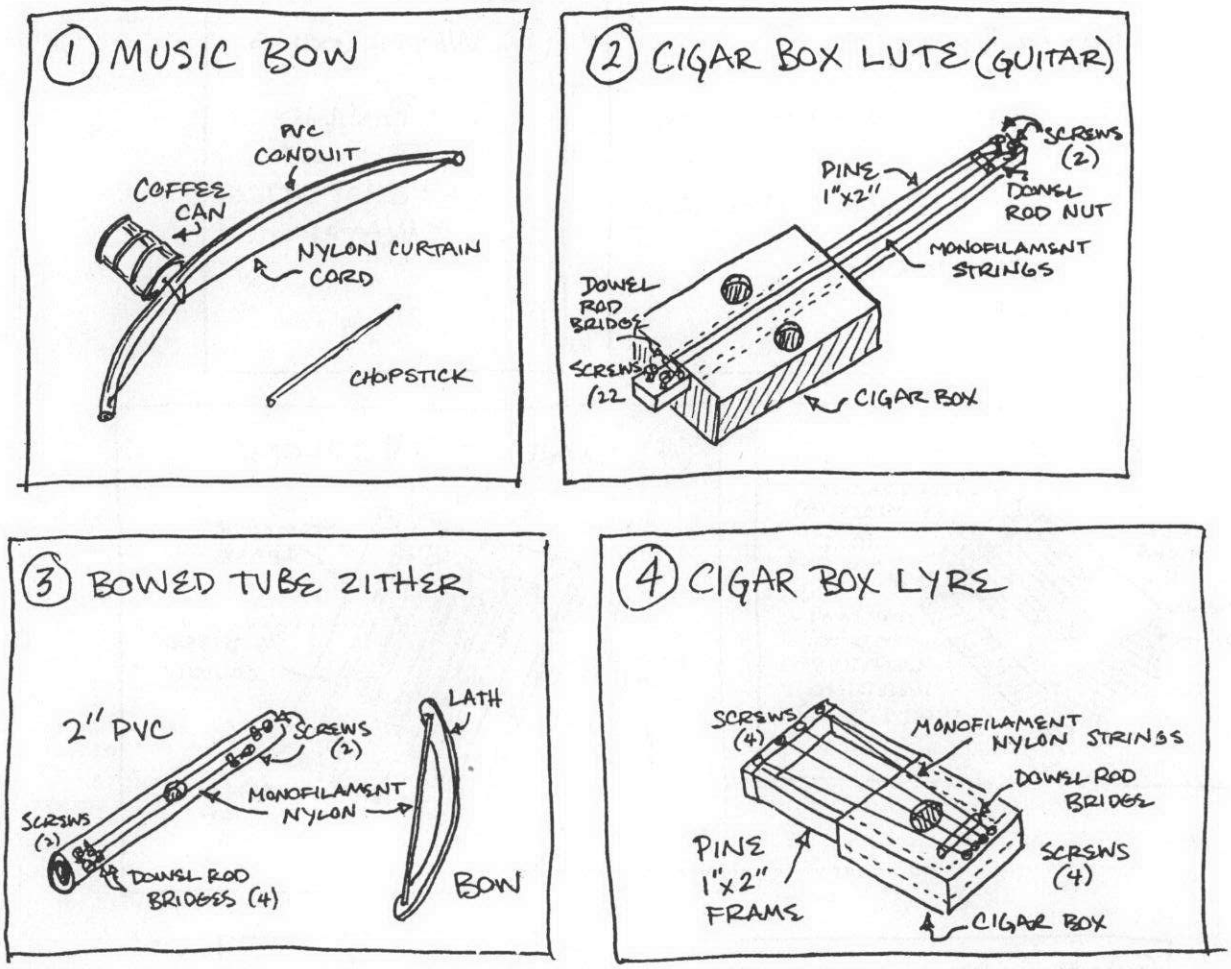


⑥ JINGLING JOHNNY

- PVC CONDUIT OR BROOMSTICK
- RATTLES, JINGLES, BELLS, ETC.
- DECORATIVE ELEMENTS

II. IDIOPHONES

NOTICE: PVC, or polyvinyl chloride, is toxic. Under prompting from concerned readers, EMI now recommends using other materials, especially in applications where there may be oral contact.



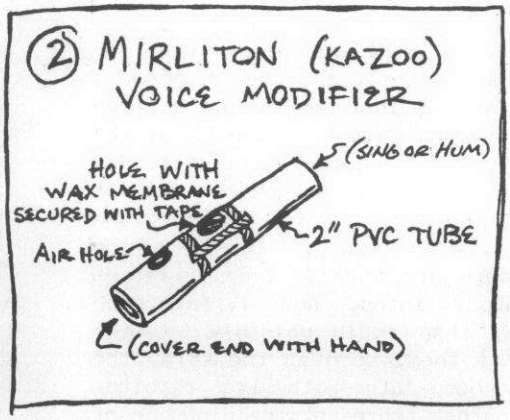
III. CHORDOPHONES

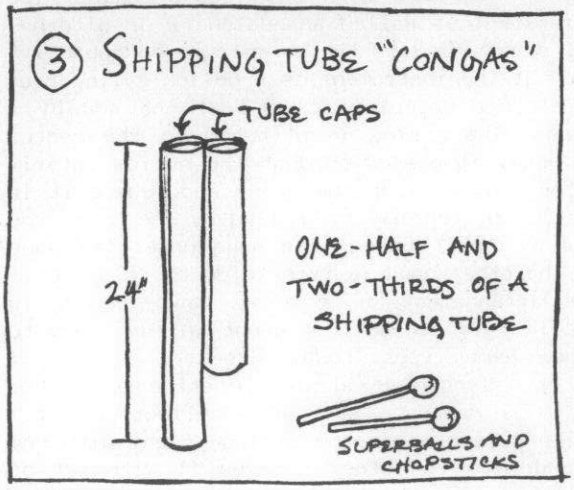
continued from page 4

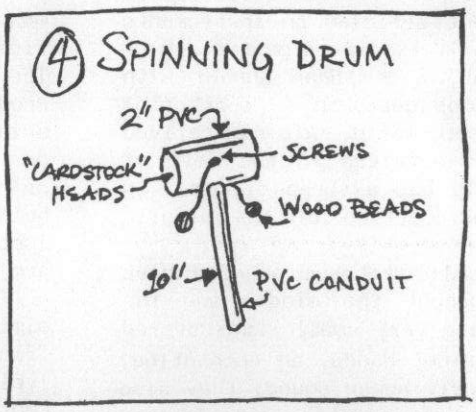
were mostly decorative rather than structural. In the third session the students were handed the component parts of their proposed instruments, and these they decorated in accordance with their sketches. Following the third session Gregg assembled the instruments, and in the fourth they were returned to the students for the final decoration.

The students enjoyed the project. "How come our music teacher never told us about these kind of instruments?" said one. Many of the completed instruments were fairly quiet -- perhaps not entirely a bad thing for a classroom environment. The loudest instrument, and (coincidentally) the most popular, was the trumpet. The general success of the program aside, Bob now feels that it would have been beneficial had he had more time with the students. It also might have worked better with older students, able to take a more active role in the construction process.

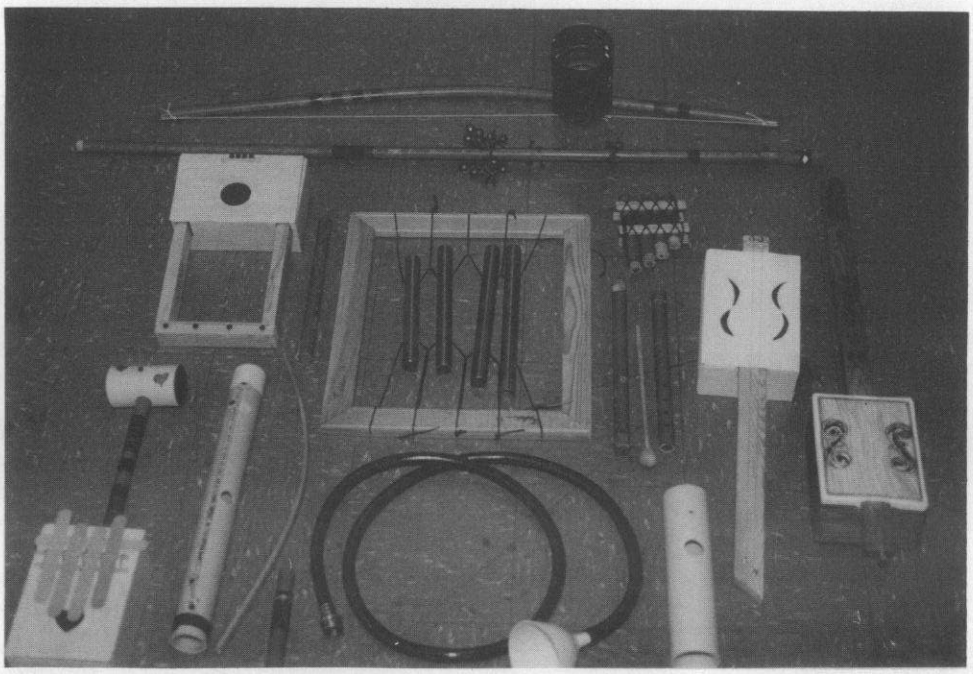
The sketches shown here are the plans from which the instruments were constructed. They are designed for simplicity of construction and ready availability of materials, as well as musical effectiveness.







IV. MEMBRANOPHONES



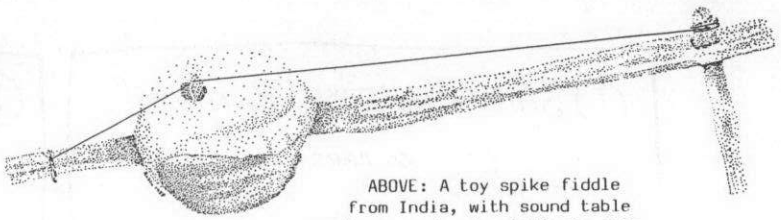
At right:
Several completed instruments from the project.

MEMBRANES, continued from page 1

pulsations.

Perhaps the second most prominent use for membranes -- following their use as drumheads, that is -- is in string instruments, as a sound table over a resonating chamber, supporting the bridge and serving as a sound radiator. In traditional instruments throughout the continent of Africa, sound tables made of stretched membrane have been the norm, with wood and metal running distant second. There are more African varieties of hide-faced harps, lutes, and lyres, both plucked and bowed, than could possibly be mentioned here. Some of them, such as the Kora, the beautiful Gambian harp-lute with its rawhide-covered gourd resonator, represent the pinnacle of long and highly developed musical traditions. Included in EMI's recent articles on instruments of horn and shell (Vol. IV #2) was a photograph of another such instrument, a Morrocan Gunbri with a thinner skin -- perhaps goatskin -- supporting the bridge. In the new world, African-derived skin-covered lutes have survived in the form of the banjo, which usually had a sheep or goatskin head prior to the introduction of the plastic heads now common.

String instruments with membrane sound tables are common also throughout the middle and far east. Spike fiddles using very small skin-covered heads produce, in the right hands, an enchanting, at the same time strangely human sound; they also are capable of a convincing imitation of a frightened cat. The Chinese er hu, traditionally made with snake skin sound table, is one such; its Japanese relative the Shamisen specifically uses the skin of a female cat on both the front and back face.* There are also middle eastern short neck lutes, both plucked and bowed, including the many members of the rabab family. One such is the Iranian tar, with its soundboard of unborn lamb skin and its remarkable figure eight shaped chamber.*



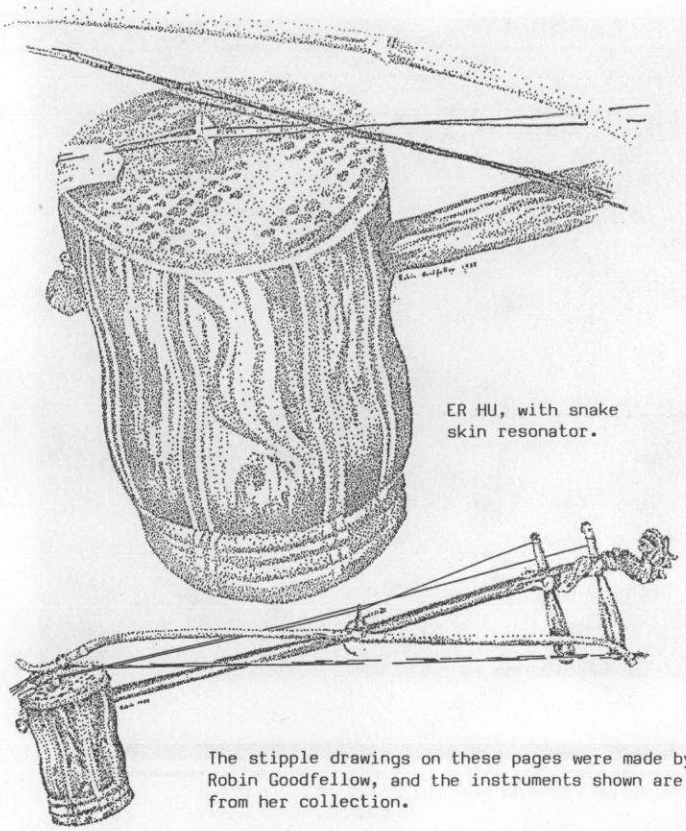
ABOVE: A toy spike fiddle from India, with sound table membrane made of relatively thin paper. About 15" long, with with clay pot sound chamber & wooden neck. It plays moderately loud, considering the size.

In India there is a family of variable tension plucked chordophones with skin sound tables. The most prominent is called anandalahari or alternatively, something like the onomatopoeic "gubgubi." The body of the instrument is a hollow cylinder of wood or other material, closed at one end by a skin head. The string is attached to the center of the head. It passes through the hollow interior of the body and out the other end, where it is held tight and tension controlled by one hand (the instrument itself being held snug under the same arm). The other hand is free to do the plucking.

This arrangement of membrane and string is similar in form, though different in function, to friction drum types found around the world. Typically a length of string is attached to the center of a membrane set on a cylindrical drum body. The player holds the string taught with one hand, and with the other strokes it with wet or rosin-coated fingers. This produces an indescribable sighing, groaning sort of sound. Friction drums are also made with sticks in place of strings, the best known of this type being the highly expressive cuica used in Brazilian folk and popular music. Whirled friction drums exist as well: in these a string is attached at one end to a drum membrane, while at the other it loops around the end of a stick, where it fits in a lateral groove that keeps it from slipping off the end. The player uses the stick to whirl the whole assembly. Vibration initiated by friction between the stick and the rotating string is communicated through the string to the drumhead, which in turn communicates it to the surrounding air.

A very similar arrangement was at the core of the Intonarumori, or noise instruments, devised by Luigi Russolo in the early part of this century (see EMI's last issue, Vol. IV # 3). This was the extraordinary set of instruments of definite, controllable pitch designed to generate distinctive timbres reminiscent of sounds of 20th century life. While the details of construction for many of the intonarumori have been lost, we do know that most produced their sound by means of some kind of action upon a tension-controlled string attached to a membrane resonator.

A few more odds and ends: Stretched membranes



ER HU, with snake skin resonator.

The stipple drawings on these pages were made by Robin Goodfellow, and the instruments shown are from her collection.

*Information on most of these instruments is available from a wide variety of sources, but it might be worth noting here that **American Lutherie**, published by the Guild of American Luthiers (8222 S Park Ave, Tacoma, WA, 98408) has made available complete building plans for some of them, including shamisen (AL #12, Winter 1987) and tar (AL #10, Summer 1987).

are used in rattles in some parts of the world, with pebbles or similar materials striking the skin when shaken to produce the sound. As part of the body of an instrument, membranes stretched between rigid structural members can be used to enhance the resonance of many instruments even when they are not themselves in direct contact with the initial source of vibration (for examples of this, see Marcia Mikulak's Harp Resonator, and Ellie's harp in the same article in EMI Vol. III #3).

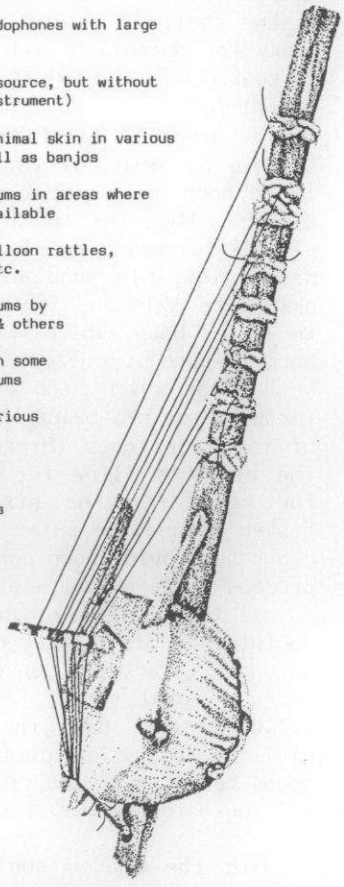
For the last several paragraphs I have been trying to ferret out and expose the wide variety of musical uses for stretched membranes. There are a few, though, that I have glossed over. In particular, these are: rubber balloons and various musical applications thereof; other sorts of inflated bladders; and mirlitons (membranes which serve to modify existing sounds by vibrating along with them, as in kazoos). Why have I held back on these while giving reign to my natural verbosity on other sorts of musical membranes? Because EMI has tentative plans for more complete articles on these specific types at a later date.

And now on to more detailed descriptions of conga drums and tabla.

SOME OF THE MATERIALS USED FOR MUSICAL MEMBRANES

Any number of different materials can and have been used in membrane instruments; this list gives a healthy sampling along with typical applications for each type.

Cow hide	Large drums, chordophones with large resonators
Lizard skin	(reported in one source, but without specifying the instrument)
Fiberglass & synthetics	substitutes for animal skin in various drum types, as well as banjos
Large game skin, buffalo hide, etc.	used for large drums in areas where such skins are available
Balloon rubber	balloon drums, balloon rattles, balloon flutes, etc.
Small game skin, deer, rabbit, etc.	used for small drums by American Indians & others
Fish skin	Reportedly used in some middle eastern drums
Fabrics	Some bagpipes, various sorts of bellows
Animal bladder	Bagpipes, bumbass
Goat skin, sheep skin & parchment	middle sized drums & chordophones
Paper	some toy drums & chordophones
Peritonium	Kamakshi veena
Cat skin	Shamisen
Snake skin	Er hu



At right: minature Kora from Gambia

CONGAS ACCORDING TO CARRAWAY
by Bart Hopkin in consultation with Jim Carraway

In the last few decades, conga drums have become a standard ingredient in a broad range of North American popular music styles. Given the African roots of much American music, congas have important symbolic associations in addition to their purely musical value: they are the best representative on this side of the Atlantic of an entire genre of West African membranophones. Congas don't come to us directly from Africa, though, but by way of Cuba.

It was in Cuba that the familiar form for the contemporary Conga drum evolved. It took shape as a composite of various earlier Afro-Cuban elongated, single-headed drums (some still surviving), which were associated with diverse regional styles. These in turn were derived from African types. In the urban popular music that began to evolve in the island before the turn of this century, the many forms gradually gave rise to a single, loosely standardized drum type. Originally these congas, like their forebears, had skins attached by pegs driven into the body or other low-tech means. Sometime around the 1890s they began to appear with tunable heads secured by hoops, side brackets and threaded bolts -- a distinguishing innovation which has proven essential to their modern character. Congas came to New York and Miami with Cuban immigrants and an ensuing popular tide of Afro-Cuban music in the thirties and forties. As they gradually found their way into the mainstream of North American popular music, and as North American popular music has found its way around the world, congas have become one of the world's near-universal musical instruments.

Most of the information in the following article was gathered in consultation with conga builder Jim Carraway of San Rafael, California. Jim has been making Congas for 20 years, and is presently completing a set of three very large (43" high) drums for Baba Olatunji, among other orders. He continues to use labor-intensive methods, as well as thought-intensive methods, that make for exquisite drums built only in small quantities. His woods are beautiful and often unusual -- zebra wood; purple heart; maple; paduk; in one case an un-duplicatable blend of black and English walnut from a single grafted tree -- and he brings out the distinctive qualities of each by careful milling and polishing.

For more information on Jim Carraway's drums, contact him at 95 Joseph Ct., Terra Linda, CA, 94903; (415) 499-1163.

Since our primary interest in this article is with membranes, we will begin the discussion of conga drums with a look at the skins.

Conga drum heads are traditionally made of rawhide, which is cattle skin. Other animal skins can be and have been used: goat skin, for instance, is traditionally used on some smaller hand drums. But conga bodies are comparatively large, and require a heavier skin if the upper partials are to be balanced with a full-sounding fundamental. Rawhide, the heaviest skin readily available, generally seems to have about the right

density to bring out the best in the conga's body and air cavity. Some retailers sell a mule skin conga head, but it is not clear that mule skin actually has any demonstrable advantages over cowhide; also what is sold as mule skin may not always actually be mule skin. Synthetic conga heads, made of fiberglass, are also available. They have a noticeably different feel to the player than natural hide, and tend to be a bit ringier in sound.

Pre-cut and formed conga heads can be purchased through larger music stores. Whole hides, from which the maker can cut and form his own heads, can be purchased wholesale, but are less readily available to those buying in small quantities. Hides and pre-cut heads vary in quality; here are some features to look for: Heads should be of uniform thickness to reduce the likelihood of tuning irregularities. This requirement goes against nature somewhat, since on the cow the hide is thicker on the back and thinner around the belly. Cows do get into scrapes now and then, especially since the invention of barbed wire, so one must check for blemishes or gouges in the surface. The outer surface of the hide is smoother than the inner, and serves as the outer playing surface of the drum. Skin thickness is a major factor in tone: thinner skins will tend to bring out upper partials, creating a thin, bright sound, while thicker skins create a deeper, more substantial sound by emphasizing the fundamental. Thinner skins are also easier to form and work with, and can be brought up to pitch with less strain on the drum body -- for this reason inexpensive mass-produced drums often use relatively thin skins.

The hides from which drumheads are made are not tanned (tanning is a process which softens the hide, making it usable as leather, by immersion in a bath containing tannic acid). They have been treated with a chemical to remove the hair, and run through a machine that scrapes the fat of the inside (a process called flensing). No further processing has taken place. Preservatives added to the hide are not called for, since the skins seem to last very well without them (up to ten years or more). When they do give out it is usually due to the mechanical fatigue from years of playing, not breakdown of organic materials. Skins can dry out in time, though, and in the long run they benefit from periodic applications of any natural oil such as mink oil, manteca, lavender oil, or (for those who like schmalzy music) chicken fat.

At this point, let us figuratively put the skin aside for a moment and turn to the construction of the body of the drum. Congo drum bodies typically range in height up to three feet or a little more. The head diameter is usually something less than a foot. The body is smaller at the base than at the rim, with some outward curvature or bulge in between. It is normally made with staves of hard wood, barrel fashion.

Jim Carraway, whose drums are serving as a model for this discussion, makes an outward curvature in the body that corresponds to a small section of a large-diameter circle. He cuts the staves to this shape (rather than bending as some other builders do) using a long, pivoting jig that he has made for his bandsaw. The individual staves are typically about 3/4" in thickness. This thickness, coupled with the fact that the woods used are dense, makes for a fairly heavy drum. This is good both for structural strength and for counterpoise against the movement of the skin (though this latter factor is of relatively minor significance).

The staves must then be run through the table saw with the blade set at a precise and carefully-calculated angle, to trim the edges so that the staves together form a circle of the desired diameter. They are then glued, using an appropriately-sized fiberboard disk temporarily set in the top and bottom to ensure an accurate circle. Gluing pressure is kept to a minimum, so as not to distort the wood and create internal tensions which would cause checking later. By using well-seasoned woods, with very accurate cutting of the staves and low-pressure gluing with aircraft grade epoxy, it is possible to form a true circle without resorting to any forcing of the wood or later re-shaping. Some makers of mass-produced drums accept a higher degree of imperfection at this stage, and later true the drum -- exterior surface only -- by turning it on a lathe.

Once the body is glued, it is spun on a lathe while being sanded by a special machine to even the surface. The shell is then hand sanded through 400 grit, then given 8 - 10 coats of finish, wet sanded between coats, to bring out the beauty of the wood. Then the rim, over which the skin will stretch, is rounded to reduce skin wear and to allow easy sliding during tuning. A generous radius here also feels better to the hand, not to mention the eye. The bottom inside of the shell is strengthened with fiberglass and epoxy for durability and the inside of the shell is coated with finish to slow moisture changes in the wood.

The drumhead is attached to the body and made tunable by means of the following hardware: The inner hoop is a metal hoop, slightly larger in diameter than the top of the drum, not normally visible because the edges of the skin are curled around it. This hoop is what actually holds the skin. The skin and inner hoop are pulled down by the outer hoop, which rests above them. The outer hoop in turn is pulled down by several bolts with bent heads which hook over the hoop. These pass through brackets below which are fixed to the wood of the body. Nuts threaded onto the bolts below the brackets allow for tightening and loosening the head. Five or six of these tuning bolts hooked around the outer hoop are generally sufficient to provide good control over the head tuning process (more on that later).

All this hardware can be purchased from manufacturers. Jim Carraway manufactures his own hardware (brackets, hooks and hoops) in his shop, using a metal shear, metal punch, 12 ton press, T.I.G. welder, hoop roller, and some other specialized tools. He rolls then welds the steel the hoops to fit each individual drum shell, and sends all the hardware out to be chromed.

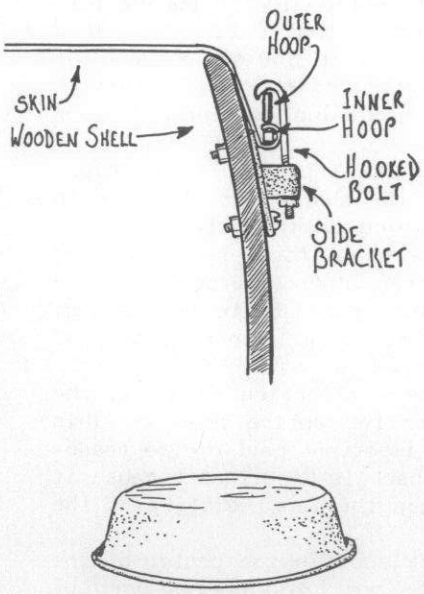
With the wooden shell finished and hardware installed, it is now possible to prepare the skin to go on the drum. To start, the skin must be

formed to fit the top of the drum and attendant hardware. (Store-bought ready-made heads may be sold pre-formed in this way). The first step in this process is soaking the head overnight. This will cause it to expand, become malleable (the dry skin is quite stiff), and take on a funny, rubbery texture. It can then be formed to the desired shape, using the top of the drum itself as a mold. It must be made to bend over the rim of the drum, then bend back up at the edges and around the inner hoop that will hold it in place. The wet hide is flexible, but not all that flexible, and this process can be seen as an interesting problem in topology, or, more to the point, as a wrestling match. It is important to avoid creating tight spots or variations in tension on the skin, which lead to irregularities in the tone. Once the skin has been coaxed into shape using vise grips and a lot of muscle, it is trimmed, then allowed to dry. Then it is checked for fit, appearance and tone quality. If everything looks right and sounds good, and the skin tunes well (even pitch all around the edge), the drum is finished.

The tuning of conga drums merits some discussion. With many early conga-type drums, it was difficult to tune with any subtlety. Different methods of mounting the head allowed varying degrees of tuning flexibility; and some change could always be effected by wetting the skin to lower the tension, and drying over heat to raise it. But with the appearance of the hoops and bolts arrangement in use now, a greater degree of control and flexibility came into being. It became possible to tune to tensions ranging from zero to very high, and along the way to dependably make very fine adjustments, including refining overtone content by tuning different areas of the playing surface somewhat independently.

This means that a drummer playing in ensemble with other tuned instruments can tune his drums to a fundamental pitch which agrees with the harmonic structure of a given piece. Since congas do possess unmistakable definite pitch, this can make a big, positive difference in the effect of congas played in ensemble. On the other hand, it also means that the drum head can be tuned for the optimal relationship with the the air chamber that it sits over. A drum in which the resonance of the skin and of the enclosed air are in agreement is a drum which is alive. De-tune them and much of the life disappears.

Unfortunately, these two approaches to tuning -- tuning to an external pitch and tuning for optimal resonance -- are incompatible more often than they are compatible. OK, life requires some choices. For my part I will say that the ideal state of being for conga drums is the situation of the living drum in tune with itself, playing alone or in ensemble with kindred instruments which do not impose an inappropriate pitch hierarchy.



Top: Congo clamping and tuning mechanism

Above: drumhead after forming

At right: drums made by Jim Carraway; one of zebra wood, and one of black and English walnut at the point of grafting.

THE TABLA PUDDI

by David Courtney

This is David Courtney's third article in Experimental Musical Instruments, the most recent being his description of the Kamakshi Veena, a bowed string instrument developed by rural Indian craftsman Nageshwar Rao. In the current article David describes the manufacture of the puddi, or drumhead, of the Indian tabla. He shows how the highly refined sound of the tabla derives from a head made very differently from any drumhead familiar to Westerners, with multiple layers of skin and an extraordinary technique for adding mass to the center of the membrane without inhibiting its flexibility.

David has studied Indian music for seventeen years, five of them in India. He is fluent in Hindi and Urdu and can understand Telagu. He is currently pursuing doctoral work, and writing his dissertation on the creation of a computerized database for Indian Ragas. His wife Chandrakantha is an accomplished North Indian classical singer. Some aspects of tablamaking not discussed in the current article are covered in a David's complementary article, "Tablamaking in the Deccan," which appeared in **Percussive Notes** Vol. 23 #2, January 1985.

INTRODUCTION

Tabla has intrigued western percussionists for a number of years. This drum of Indian origin, is noted for its unique tonal quality. This quality is derived primarily from the complexity in construction of its drumhead. The drumhead, known as **puddi** or **purri**, is indeed so complex that it would be safe to say that no other drumhead on earth surpasses it in that regard, though others may occasionally equal it.

The word **tabla** is commonly applied to both drums as a pair. This is not correct by the strict definition of the word, because actually only the smaller right hand drum is the tabla. The larger left hand drum is called variously **dagga, banyan** or **madda. Other** names for the smaller tabla are **siddha,** or **danyan.** For convenience sake this article will use the term **tabla** for both drums while the left and right hand will be called **banyan** and **danya** respectively.

Danyan and Banyan, the two drums which together are commonly called Tabla.

The fashioning of the puddi (drumhead) is a highly specialized craft. This craft is passed down from father to son in a manner typical of Indian tradition. These craftsmen are known as **tablawala,** and are usually distinct from the performers (**tablji** or **tablia**). The apprenticeship usually starts in childhood and is completed only when the craftsman reaches full maturity. A close look at the construction will reveal why it takes so long to learn the craft.

BASIC STRUCTURE

It is helpful to have a rough idea of the anatomy of a tabla puddi before tackling the subject of its fabrication. Fig. 1 shows an expanded cross section (minus the woven hoop called the gajara). There are basically three functional parts of the puddi. 1) Lacing 2) resonating membrane 3) Shai (black spot).

The lacing is composed of several components. The **gajara** is the most important, as well as the most visible. It is a heavy ring of woven leather, composed of thong made of thick buffalo hide, which is woven into the puddi around its periphery. It functions as a tensioning hoop, fitting over the top of the body of the drum and transferring tension from the lacing to the sounding skin. Another less important section is the **bunad.** This is a much lighter thong of goat skin, woven into the gajara. The **Bharti** is an invisible layer of skin on the inside surface of the puddi. This is important for giving mechanical strength to the puddi.

The resonating membrane is basically two components, the **maidan** and the **chart.** The **chart** is an upper layer of skin which covers only the outer periphery of the sounding surface, having a hole in the middle. It serves a dual purpose. On one hand it gives mechanical strength to the lacing, but on another level, it is an important part of the resonating membrane.

The maidan has the distinction of being the only skin which covers the entire opening. This is therefore the most important part of the resonating membrane. The chart is important because it has a great effect upon the tonal quality of the tabla.

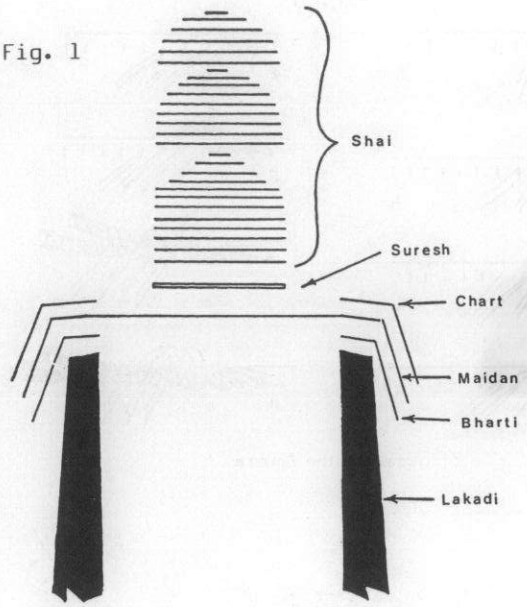
The **shai** (the black spot in the center of the puddi) is probably the most distinctive part of the tabla. It is there to give the tabla its distinctive tone. It is actually quite complex and a considerable amount of discussion will be devoted to it later.

CONSTRUCTION

Making a puddi for both the danyan and banyan is about the same. It begins by taking the rawhide of a goat and soaking it in water. Once the rawhide is wet, excess hair and tissue is removed and the whole is allowed to dry.

Templates, known as **jal,** are used to mark off circles of various sizes for use on various drums. Great care is taken so that the small scars the

Fig. 1



EXPANDED CROSS SECTION

Fig. 2

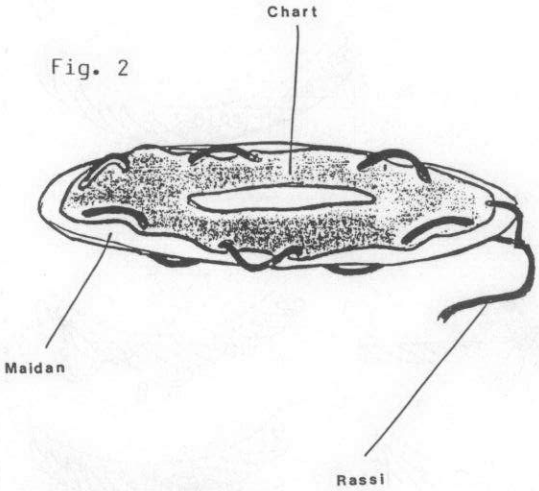


Fig. 3A

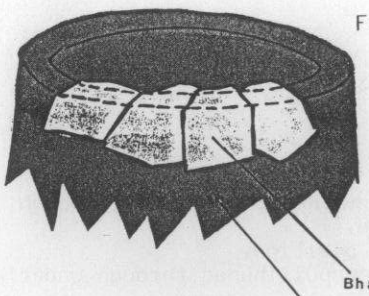
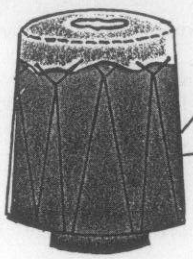


Fig. 3B



goat had acquired from ticks or other sources are avoided. The area of the neck and spine is avoided in the case of the danya, but it is considered acceptable for banya.

The circles are then cut out and the unused sections (**chiller**) are cut into trapezoids of varying sizes. These trapezoids will be used later.

The circular pieces of skin are now graded as to quality. The lowest grade will have the centers removed and be used for making the outer covering of the puddi (the chart). The medium grade will be used for the low cost, student grade tablas, while the highest grade will be used for the professional quality puddis.

The skins are again soaked in water and removed.

The chart must now be made. The lower quality skins are utilized by folding them in half several times to form a triangle. The tip is cut off, so that when it is unfolded, there will be a circle of about two to three inches in diameter that has been removed.

The chart now has to be fixed to the main playing skin (maidan). The chart is laid on top of an intact skin so that the outer surfaces of both skins face up. Insertions are made parallel to the edge of the skins with a small chisel. Care should be taken that the chart is slightly bunched up, so that on the drum all the tension will be exerted against the maidan (fig. 2). A piece of cord is inserted with a large needle and threaded back and forth through the two skins as the insertions are made. Finally the two ends of the cord are tied together.

The chart serves several very interesting functions. One of its jobs is to give strength and durability to the puddi. The main resonating membrane undergoes a tremendous amount of abuse where it passes over the sharp edge of the drumshell. This extra layer of skin increases the lifespan of the head. Under normal use, a puddi may last anywhere from one to five years.

The chart also affects the tone of the instrument. If the chart is very broad and extends inward to a great extent, it will have two effects. The first is to increase the overtones present in the tabla. A second effect is to decrease the decay and sustain time of the amplitude envelope.

That the chart affects the tone quality may be illustrated in several ways. The most obvious is the manner in which the craftsman trims the chart to give the right tone upon completion of the tabla. Another is a trick used by many musicians to enhance the tone of their instrument: a string is placed around the drum between the chart and the maidan. This may have an effect which is sometimes subtle but sometimes great. There is another trick used to make a tabla resemble the sound of **mridangam** (a south Indian barrel shaped drum). For this, small wooden pieces are inserted between the chart and maidan in a manner such that the wood extends until it just touches the shai. These are all tricks which utilize acoustic interactions between the chart and the maidan, thus demonstrating the effect of the chart upon the tone of the tabla.

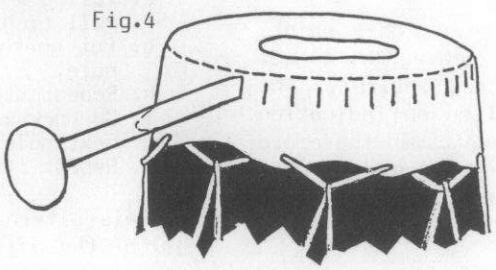
The bharti will now be made. The previously mentioned trapezoids are soaked in water, and laid around the rim of the drumshell. The shorter edges face inside (fig. 3a).

The chart and maidan, joined previously, are now stretched over the bharti and drumshell and tied securely (fig. 3b).

There is no real attachment between the pieces of bharti, maidan, and chart at the present stage of construction. The attachment will come with the weaving of the gajara.

The weaving of the gajara begins by making vertical slits around the edge of the tabla (fig. 4). The banyan requires 64 slits while the danyan requires only 48. Care must be

Fig.4



Making the Insertions

taken that all layers of skin have been penetrated.

Two long pieces of buffalo hide are used for the weaving. Each thong (tasma) is first soaked in water, then lightly covered with oil. The two thongs are inserted into three adjacent holes up to their midpoints (fig. 5a), thereby making four loose ends.

There must be a central core around which the gajara is woven. This is made by taking two or three lengths of inferior quality thong and wrapping it around the rim. The gajara is woven in the following manner:

a. Insert two lengths of thong into three adjacent holes (fig. 5a).
b. Twist in clockwise manner.
c. Go over two slits and insert (fig. 5b).
d. Pull out of third slit.
e. Go to next thong.
f. Repeat steps b, c, d (fig. 5c).
g. Go to next thong in same slit.
h. Repeat step b (twist).
i. Go over three slits and insert.
j. Pull out from the bottom of the fourth slit (fig. 5b).
k. Go to next thong.
l. Repeat steps h, i & j, but keep loose (5e).
m. Go to next thong.
n. Repeat steps h, i & j, but keep loose (5f).
o. Go to next tasma.
p. Repeat steps h, i & j, but keep loose (5g).
q. Insert core thong (fig. 5g).
r. Tighten first two thongs.
s. Take next thong.
t. Repeat steps h, i & j but keep loose (5h).
u. Insert last core thong.
v. Tighten last thong.

The gajara has now been started. Continue weaving in the following manner (fig. 6a).

1. Take thong from bottom.
2. Twist 1/2 turn in clockwise fashion.
3. Go over two slits and insert in the third slit on top of core thong.
4. Pull out of bottom of fourth slit.
5. Go to next thong and repeat.

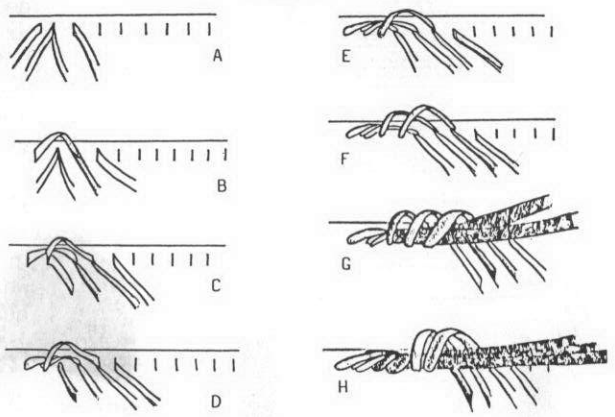
Eventually the weaving must be finished. The weaving will end in the following fashion:

1. Stop weaving when thong exits at starting point (fig. 7a & 7b).
2. Cut outer core thong so that it extends 1½ inches over starting point.
3. Cut inner core thong so that it just touches starting point.
4. Cut middle core thong so that it extends ½ to 1 inch over starting point.
5. Twist thong ½ turn in clockwise direction.
6. Pull thong over four spaces and insert between chart and gajara.
7. Pull tight (fig. 7c).
8. Go to next thong and repeat steps 5, 6, 7, & 8 for the next 7 times (fig. 7d, e & f).
9. Trim off excess thong.

The gajara is nearly complete at this point. The only remaining step is to weave the bunad. Many craftsmen eliminate the bunad entirely. The absence of bunad, though, is often an indication of laziness on the part of the craftsman therefore its absence is often an indication of poor quality. The weaving of the bunad goes as follows (fig. 6b):

a. Pull a strip of dry goat hide thong between gajara and chart (pull up).

Fig. 5



Weaving the Gahara

Fig. 6

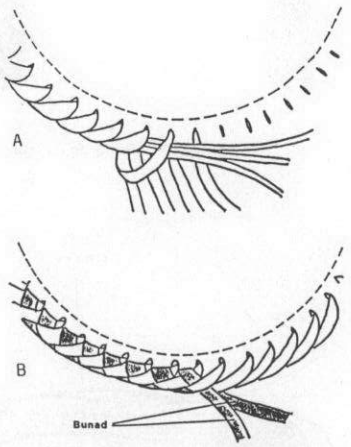
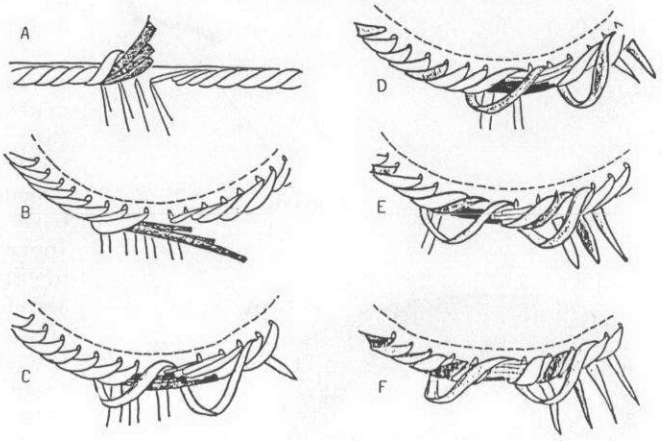


Fig. 7



b. Skip closest thong and pull bunad through under the next one.
c. Pull into correct position.
d. Skip next thong and pull bunad through under next one.
e. Pull down to proper position.
f. Pull tight.
g. Put another piece of bunad through the next hole.
h. Repeat steps b,c,d,e & f.
i. Go back and pull the first bunad through the next hole.
j. Repeat steps b, c, d, e & f.

This alternating back and forth proceeds until all of the gajara is done. Upon completion of the bunad, the gajara is complete.

As mentioned earlier, the gajara performs the

function of transferring the tension from the lacing to the maidan. However, it does so in a manner which is considerably more refined than the usual ring found in most western drums. The reason is that the gajara actually has a buffering aspect upon this tension. This buffering is important because very little variation in tension is tolerated on tabla. This low tolerance is a natural consequence of the requirement for precise tunability. An interesting feature of this strong buffering effect is that changing the tension on the lacing functions as a "coarse tuning," while lightly hitting the gajara with a small hammer acts as a "fine tuner." In practice the majority of tuning is done without any change in the tension of the lacing at all.

The gajara also performs the necessary but mundane function of joining all three levels of skin (bharti, maidan, and chart) together.

The puddi is now removed from the shell and the bharti is trimmed. The bharti is trimmed by taking a flat piece of bamboo and slipping it between the maidan and the bharti. The bamboo piece is used to shield the maidan from the blade. The bharti is trimmed so that there is an even $\frac{1}{2}$ inch projecting into the middle of the puddi.

The function of the bharti appears be entirely mechanical in nature. The bharti reinforces the maidan and keeps it from tearing under high tension.

The puddi must now be remounted.

THE SHAI

It is now time to apply the shai (black spot).

A base for the shai must be established. This is done by boiling gum resin with a small quantity of water (**raal** or **suresh** or **sharesh**) until it becomes soft and gummy. It is then applied to the exposed surface of the maidan to form a circle of approximately $3\frac{1}{2}$ for danyan or 4 to $4\frac{1}{2}$ inches for the banyan. The circle is allowed to dry in the sun.

Shai Massala is a key ingredient for the creation of a shai. This is a commercially available powder reputed to be composed of soot, iron dust, and other unidentified vegetable matter. It is said that the best shai massala comes from Bhawnagar in the western state of Gujarat.

To prepare the paste for the shai, a little vessel is filled with a small quantity of water and white flour. This is heated and mixed to make a glue (**lai**). The glue is now mixed with shai massala. The whole mixing process is done in a rubber mat made from an old inner tube. After a thorough mixing the paste is finished. The application of a layer involves three steps:

Step 1: The shai paste must be applied. This is done by using the first finger of the right hand to take up a small quantity of the paste. The paste is quickly applied with a circular motion of the finger to the area previously covered by the gum. Support is given to the first finger by placing he second finger over the first.

Step 2: Excess paste must then be removed. This is done by scraping with a curved metallic strip. The tabla is rotated during this process so that the application is of uniform thickness.

Step 3: Polishing with a stone is the final step. Immediately after the excess paste has been removed, a polished piece of basalt is used to rub the shai repeatedly. The pressure is very important. It starts gently and builds up to quite a considerable pressure. Periodically the stone is rubbed against the cheek to deposit a microscopic layer of sweat. This polishing is very important because it will determine the density of the cracks which are visible in the shai. These cracks will be discussed at greater length later.

Steps 1, 2 & 3 are repeated for more layers. The diameter of each layer remains full size until four of five layers have been applied. Then the diameters are gradually reduced until the diameter is hardly more than $\frac{1}{4}$ inch. A few full size layers are again applied, followed by decreasing sizes. This process continues until the desired thickness and shape are attained. This, too, will be discussed later.

The finished shai is perhaps the most distinctive part of the tabla. It has perhaps a greater impact on the tone of tabla than any other part. For a further understanding it is necessary to understand how membranes resonate.

A membrane stretched over a hoop with equal tension resonates in a most unmusical manner. It is very rich in inharmonious overtones, and the amplitude of the fundamental frequency tends to be nearly zero. Two philosophies prevail on how to develop a simple drum's tonality. One approach is to further muddle the harmonic structure by the well-known "snare". This has been a traditional western approach for a number of centuries. The effect of such is to have a drum which for all practical purposes produces no defined pitch.

A completely opposite philosophy exists in efforts to give the drum a more defined pitch. A classic approach is to attach the membrane to a resonator and use the membrane excite the air enclosed. Such an approach is found in timpani and in congas. Of relatively recent origin (in the West) are methods involving modification of the skin itself. Stories abound of conga players who take a heavy hide and sand the periphery of the skin so that the finished drumhead is thicker in the middle and thinner at the edge. Another example is the adhesive dots placed at the center of many marching drums. For both cases, the increased mass in the center serves to enhance the fundamental frequency and suppress the upper harmonics.

This is exactly what the shai does. It produces a very clearly defined fundamental frequency, therefore a very clearly defined tone. One of the ramifications is that a change in the tabla can be effected by changing the shai and not having to do anything to the skin itself. Therefore it is very usual to find tabla made of the same thickness of skin, on the same size rim, having totally different resonant frequencies. One of the reasons is that a thick shai will lower the fundamental while a thinner shai will raise the fundamental.

There is one caveat that must be kept in mind. The shape of the shai is very important. The shai will always be thicker in the center and thinner

at the edge, but by how much? If it is not correct there will tend to be parallel harmonic structures. If these structures have fundamental frequencies which are dissonant, then different strokes on the drum will tend to evoke different pitches. This is not at all acceptable to Indian music, which requires a clearly defined tonal base.

There is one more point that should be mentioned. We have applied the shai in numerous thin layers. However, it no longer behaves in that manner. It functions in a manner totally different from the way it was applied. The key to this difference lies in the network of cracks which permeate the shai.

It is clear at a glance that the shai covers a considerable area of the skin. It is obvious that the ingredients of the shai harden to the consistency of cement. Such a hard consistency is at direct odds with the skin's requirements of uninhibited vibration. The cracks are the key to the shai having flexibility, even though it is composed of such rigid materials. The cracks are a visible indication that what appears to be a monolithic application is in reality a matrix of unconnected particles, bound firmly to the skin yet unconnected to each other. Because they are unconnected, the entire shai exhibits a surprising degree of flexibility.

The next step is to trim the chart. It will be trimmed to a width of approximately $\frac{1}{4}$ to $\frac{1}{2}$ inch. The maidan will be protected from the blade in this process by a bamboo section in a manner similar to the trimming of the bharti.

The final phase is purely cosmetic. Any excess shai can be trimmed away by a blade. The outer surface of the skin will then be lightly sanded with sandpaper. Lastly, chalk will be applied to the chart and maidan and lightly sanded again. This chalk is why new heads always have white skin, but tablas that have been used have a sort of cream color.

The puddi is now finished.

CONCLUSION

We have endeavored to do two things with this article. We have tried to give the minimum amount of information necessary to allow one to make a tabla puddi. Needless to say, the first attempts would naturally produce only some crude puddis, but with some practice, some quite nice puddis could be created. Second, we have attempted to briefly describe the function of a few of the parts of the puddi. Again, a considerable amount of work would be necessary to describe the physics in great detail. Perhaps somebody would like to do so.

Any way one looks at it, the tabla puddi is an interesting object of contemplation.

The author at work with other tabla makers.

GLOSSARY

Included here are Indian terms which recur in this article.

Banyan: The larger of the two drums that make up the pair of drums commonly called tabla.

Bharti: a layer of goatskin, made up of small overlapping trapezoidal pieces, placed around the rim of the drumshell under the main sounding membrane (Maidan) for added strength and reduced wear.

Bunad: A goat skin thong which is woven into & becomes part of the Gajara.

Chart: An additional skin which lies over the main sounding membrane (Maidan). It covers the outer edge of the playing surface but has a hole in the middle leaving the center of the maidan and the shai exposed. It adds strength and affects the tone.

Danyan: The smaller of the two drums that make up the pair of drums commonly called tabla.

Gajara: The leather hoop used to hold the several layers of the tabla drumhead (puddi) in place and transmit tension from the lacing to the drumhead. It is made of buffalo hide thongs woven to form a strong ring, and is itself woven into the outer edge of the puddi so as to hold firmly and fit snugly over the rim of the drumshell.

Maidan: The main sounding membrane of the tabla, and the only one which covers the entire opening of the drumshell; made of goatskin.

Puddi: Name given to all the components together of the tabla drumhead.

Shai: the black spot seen at the center of the drumhead, made from a special paste. It defines the tone.

Tabla: Properly speaking, refers only to the smaller (Danyan) of the two drums, but in common parlance and in this article, the term is used for the pair, Danyan and Banyan, taken together as they are normally played.

Tasma: Thongs of buffalo hide used to make the gajara.

Books & Recordings

SPIKE JONES: THE CRAZIEST SHOW ON EARTH
Three record set, produced in 1977 on G & O Records and distributed by M.F. Distribution Co.

SPIKE JONES AND HIS CITY SLICKERS, by Jordan R. Young, with a foreword by Dr. Demento
Oversized paperback book published by Disharmony Books, Beverly Hills, CA, 1982.

Reviewed by Bart Hopkin

Spike Jones (1911-1965), also known as the King of Corn, was the foremost American master of funny noises.

Born Lindley Armstrong Jones, he took up the drums at age eleven. By the late thirties he had achieved moderate success as a straight drummer in Hollywood studios, playing for Bing Crosby, Hoagy Carmichael and others. At the same time, he had developed a habit in his free time of collecting every kind of odd noisemaker he could find. A former sideman reports that once, after a gig at the Biltmore Hotel, Jones went so far as to rip the telephones off the hotel wall, tuck them under his coat and walk out the door, loose wires dangling behind.

Jones felt rather constrained by his regular work (which, given the bandleaders he was working under, tended to be more sweet than hot), and he began to see in his off-hours habit a possible alternative. Over time his collection of sounds grew; his apartment and then his station wagon gradually filled to the brim with interesting junk; eventually he started getting sound effects work in radio studios. With his straight drumming receding in importance and funny noises moving to center stage, in 1942 he formed his own band, **Spike Jones and his City Slickers.** (How come no one uses possessives in group names anymore?). In that same year the group recorded a song entitled "Der Fuehrer's Face." It was this completely irresistible piece of inspired goofiness that brought the group to national prominence.

"Der Fuehrer's Face" was one big humorous insult to Adolph Hitler, a theme most Americans were highly sympathetic to at the time. It was written by an Englishman named Oliver Wallace, who had to his credit the score for the movie **Dumbo.** The song, in fact, was composed for another Walt Disney creation, a cartoon tentatively titled "Donald Duck in Axis Land." Spike Jones and friends got hold of it and recorded it for RCA Victor before the release of the cartoon. Jones then had a hard time of it to convince both Disney and Victor executives to allow the song to be released, despite his fervent contention that failure to do so would show a reprehensible lack of patriotism in wartime. When they did release it, the initial pressing was only 500 copies. Jones took it upon himself to augment Victor's meager promotional efforts. One thing he did was to make sure that it got into the hands of the right DJs. Martin Block at WNEW in New York saw fit to play the record every half hour, offering a free copy to anyone who bought a $50 War Bond. By this means Block sold over $60,000 worth of War Bonds in two weeks. At the same time made Spike Jones and his City Slickers into overnight stars, and launched the group on a twenty-year career of musical zaniness in radio, TV and concert halls. Riding on this success, the Disney cartoon, now renamed "Der Fuehrer's Face," was released and went on to win an academy award.

Most of the band's repertoire involved ridiculicization of familiar songs, achieved by performing them in inappropriate styles, adding various extra-musical stage elements, and, of course, inserting appropriate sound effects. To this body of material were added a number of humorous songs written by Spike Jones or other members of the band. The core instrumentation of the band varied widely from one piece to the next, depending on the artistic intent: on one track it might be banjo, tuba, trombones and higher winds playing in a sort of manic Dixieland style; on another it's the harps and celestial choruses of the schlockiest of Hollywood schlock. To make all this possible, the touring ensemble numbered at times over forty performers (in their heyday, live performance was the group's bag more than recording).

Framed by the Dixieland brass and the Hollywood schlock was Spike Jones' battery of outrageous sounds. Few were truly new and unusual. Most were familiar sounds which had non-musical associations; indeed, much of their effect depended upon this. There were duck calls, sirens, various sorts of auto horns including the old fashioned squeezy kind, anvils, pistols, alarm clocks, telephones, doorbells, washboards and kazoos. Prominent in many recordings is a tuned cowbell set of erratic timbre, which somehow in performance has a far more comical effect than description alone would suggest. It is a rubber razzer that makes the gesture of supreme reverence in the Hitler send up: "Den ve heil! (Ptht hthpt!) Heil! (Ptht hthpt!) Right in der Fuehrer's Face!" The Latrinophone was a toilet seat with strings across it. Jones also somehow managed to get definite pitches from insecticide spray guns, and even found use for a goat capable of bleating on

cue and on a predictable pitch.

In the period immediately following their rise to stardom the group emphasized purely musical gags, playing their instruments in deadpan style as they set the audience up for some grand musical incongruity. Over the years they moved increasingly to slapstick, with a Vaudevillean use of props and non-musical materials to get laughs. In "Spike Jones' Musical Depreciation Review" (as the touring show came to be called) water, snakes and pigeons came forth at different times from the mouths of tubas and trombones; pigs slid down chutes; a trombonist's pants went up and down in rhythm with his playing. When Jones fired a pistol in the air a smattering of dead ducks fell from above, followed by a single duck floating down with a parachute.

The group carried on lustily through the forties and fifties, adapting nicely in those later years to the arrival of TV. It was only when Jones' health gave way in the beginning of the 1960s that they stopped performing for good.

At the time he got started, Spike Jones was not the only musician doing this kind of stuff. Other novelty groups, often playing a variety of unlikely instruments, were performing with some success around the country. Among them were the Hoosier Hot Shots, Freddie Fischer's Schnickelfritz Band, and Frank and Milt Britton (whose schtick involved breaking instruments over one another's heads).

This sort of music, tragically, has since waned in popularity. Still, the King of Corn remains available on disk. In addition to the album discussed below, Spike Jones' music can be found on various LPs, 78s and 45s released by Warner Brothers, RCA, Liberty and several smaller labels.

Spike Jones: The Craziest Show on Earth is a three record set containing thirty-seven tracks, among them all of Jones' best known numbers. That includes "Cocktails for Two," with it's famous chorus of hiccups, gulps, gurgling and other nameless functions associated with drinking; "All I Want For Christmas is my Two Front Teeth" and, of course, "Der Fuehrer's Face." Most of the tracks in this set are recorded before live audiences, so for six sides the listener has the added bonus of being continuously subjected to the sound of people dying of laughter.

The notes that come with the package are rather sparse. But there is a nice photograph on the back cover, showing five men with silly expressions on their faces standing before a truly enticing array of noisemaking gadgetry.

The sound quality in many of the recordings is poor -- and you can't dismiss this by saying it doesn't matter for this kind of music, because, in fact, crucial to their success is the fact that these guys actually were good musicians.

Three disks of this kind of craziness is a lot to deal with, and, even putting recording quality aside, the standard is not uniformly high. "You had to be there" might be a key phrase for many of the takes included. No matter. It remains a valuable document and a lot of good entertainment.

A note on availability: I found this collection in, of all places, one of those publishers' overstock discount catalogs, suggesting that it may no longer be in stock through standard channels. That source was Publishers Central Bureau, 1 Champion Ave., Avenel, NJ, 07001-2301.

Much of the information in the earlier part of this article came from the only published biography of Spike Jones, **Spike Jones and his City Slickers**, by Jordan R. Young. The book contains an account of Jones' life and work as interpreted by the author, followed by sections devoted to reminiscences of several close associates. There is an extensive discography, and a less extensive bibliography (since little material of any permanence was ever written about the man). Spike Jones was great for self-promotion, and a lot of his ads, posters and record jackets are reproduced as well.

The book makes interesting reading for the ups and downs of a showbusiness career, the glimpses of the personality behind the zany music, and the tales of life on the road with a bunch of practical jokers. Unfortunately for EMI types, it devotes little space to Spike Jones' sound source collection, and only a few of the many photographs contain clear images of instruments.

JUST INTONATION CALCULATOR, by Robert Rich. Macintosh Hypercard stack makes JI easy: shows scales to 48 notes/octave; calculates transpositions; reduces fractions; converts between ratios, cents, DX7II, TX81Z units; internal sound. Only $10. Soundscape Productions, Box 8891, Stanford, CA, 94309.

PERSONAL ETHNIC: a new 60 minute cassette of the music & flutes of Susan Rawcliffe with Alex Cline. Send $6.50 + $1.50 shipping & handling to Susan Rawcliffe, 2278 Allesandro, Los Angeles, CA 90039.

CRITTERS is a new cassette of music played by Tom Nunn on original instruments including Crustacean and Blossom (space plates, using plucked and bowed bronze rods on stainless steel sheet resonators), and the Bug (an electroacoustic percussion board). $8.00 plus sales tax in California, from Tom Nunn, 3016 25th St., San Francisco, CA 94946.

The Center for Safety in the Arts is seeking information on padding, straps, instrument modifications and such used to support musical instruments to prevent musculoskeletal problems. Send brochures, photos, descriptions, etc., to 5 Beekman St., Suite 1030, New York, NY 10038.

NEW MUSIC AMERICA MIAMI FESTIVAL takes place Dec. 2-11, 1988. Sound sculptures, acoustic explorations and performances with unusual instruments are included. New Music America Miami, MDCC/Wolfson Campus, 300 NE Second Ave., Miami, FL 33132-2292; phone (305) 347-3768 for information.

WATERPHONES -- Two new models are available. "Small" for $185 and the "Whaler" -- $295. These stainless steel and bronze instruments are easy to play by bow, mallets and by hand. Write Richard Waters, 1462 Darby Rd., Sebastopol, CA 95472. A demo cassette is available for $8.00.

CASSETTE TAPES FROM EMI: From the Pages of Experimental Musical Instruments, volumes I, II and III are available from EMI at $6 apiece for subscribers; $8.50 for non-subscribers. Each tape contains music of instruments that appeared in the newsletter during the corresponding volume year, comprising a full measure of odd, provocative, funny and beautiful music. Order from EMI, PO Box 784, Nicasio, CA 94946.

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Balungan, a publication of the American Gamelan Institute. Information on all forms of gamelan, Indonesian performing arts, and related developments worldwide. Subscription (three issues) $12 individual, $16 foreign, $20 institution. Archives Distribution Catalog, listing tapes, monographs, scores, and videos, $2. Box 9911, Oakland CA 94613. (415) 530-4553.

Frog Peak Music (A Composers' Collective). Publishes and distributes experimental artist-produced books, scores, tapes, and innovative music software. Catalog on request. Box 9911, Oakland CA 94613. (415) 530-4553.

Musicworks: The Canadian Journal of Sound Explorations. Journalistic and audio perspectives on all aspects of music and music-making. Subscription (3 issues annually) $26, includes cassettes. Sample issue (28 pages) with 60 min. cassette, $8.75. 1087 Queen St. West, Toronto, Canada M6J 1H3. (416) 945-4458

1/1: The Quarterly Journal of the Just Intonation Network, David B. Doty, editor. Serves composers, musicians, instrument designers and theorists working with tunings in Just Intonation. One year membership includes subscription. Individual, $15 US, $17.50 foreign; institution $25. 535 Stevenson St., San Francisco CA 94103. (415) 864-8123.

Experimental Musical Instruments. Bimonthly newsletter and yearly cassette documenting new acoustic and electroacoustic sound sources. Subscription $20/year, tapes $8.50 general, $6 to subscribers. Sample issue on request. PO Box 784, Nicasio CA 94946.

Soundings Press. Since 1972 Soundings Press has published an annual anthology of scores and articles by today's young composers, and composers active earlier in the century: Nancarrow, Harrison, Bowles, Cowell, Partch, Revueltas. The radical edge of contemporary American music. Free 16-page catalog upon request. PO Box 8319, Sante Fe NM 87504.

RECENT ARTICLES IN OTHER PERIODICALS

Listed below are selected articles relating to unusual musical and sound instruments which have appeared recently in other publications.

EARTH, FIRE, SAKTI, AND THE JAVANESE GAMELAN by Judith Becker, in **Ethnomusicology** Volume 32 #3, Fall 1988 (PO Box 2984, Ann Arbor, MI 48106).

An unusual look at the instruments of the Gamelan from the point of view of the spiritual properties that they embody for those that use them.

Also in **Ethnomusicology** Volume 32 #3 (address above) are reviews of some new books on instruments, including two in French on the subject of Sansas, and one in Spanish which catalogs the instruments of Colombian collector Jose Ignacio Perdomo.

MUSIC OF THE MAYA by Paul F. Healy, in **Archaeology** Jan/Feb 1988.

A report on recent findings of flutes and ocarinas at Mayan sites in Belize, discussed in the context of current knowledge of Mayan culture. In the same issue is a report on an opera now being composed by Richard Cameron-Wolfe, scored for a variety of Indian instruments.

MUSIC FOR THE EARTH AND SKY by Ruth Dore, in **Artspace** Volume 12 #4 (2227 Lead SE, Albuquerque, NM 87106).

A discussion of the work of Louis Ballard, a composer of native American descent who features traditional Indian instruments prominently in his work. A floppy 33 rpm soundsheet is included with the magazine.

VIOLIN VISIONARY L. SHANKAR in **Strings** Volume III #2, Fall 1988 (407 San Anselmo Ave., San Anselmo, CA 94960).

An interview with the Indian violin virtuoso. In it he discusses his double-necked, 5-strings-per-neck electric violin, made by Stuyvesant Sound in New York; photos are included.

THE WITTEN-RAWLINS COLLECTION OF NORTH ITALIAN STRING INSTRUMENTS by Joseph R. Johnson, in **American Lutherie** #15, Fall 1988 (8222 South Park Ave., Tacoma, WA 98408).

Some history, a checklist, and several photographs of the beautiful and unusual plucked and bowed string instruments from this collection now housed at the Shrine to Music Museum in Vermillion, South Dakota.

HEY MISTER BASS MAN! by Tim Olsen, also in **American Lutherie** #15 (address above).

Notes from a visit to the shop of Hammond Ashley Associates, maker of string basses including the big bass member of the New Violin Family.

HANNA TIERNEY, "DRAMA FOR STRINGS IN THREE MOVEMENTS: LIGHT-SOUND-GESTURE by Donald Marinelli, in **High Performance** #43, Fall 1988 (240 S Broadway, 5th Floor, Los Angeles, CA 90012).

Review of a performance of a kinetic sound sculpture created and controlled on stage by Hanna Tierney.

INSTRUMENT INNOVATIONS: THE "BUG" -- A PORTABLE ELECTROACOUSTIC PERCUSSION BOARD by Tom Nunn, in **Percussive Notes** Volume 27 #1, Fall 1988 (Box 697, 214 W. Main St., Urbana, IL 61801-0697).

Tom Nunn describes the latest addition to his family of percussion boards, the Bug.

Several articles relating to new instruments have appeared in the last two issues of **Ear** (325 Spring St., New York, NY 10013).

From Vol. 13 #6, Sept. 1988:

IT'S ALIVE by Helen Thorington describes MIT's Tod Machover's plans for the Hyperinstrument. It is described as a musical computer endowed with as much artificial intelligence as its makers can muster, capable of responding to input from several human musicians in ways that will create new approaches to ensemble playing.

LIZ PHILLIPS AIR PLAY by Leigh Silverman describes Phillips' sound sculptures, in which environmental information from particular spaces (wind velocity; presence of people moving about) is sent to a computer which, through some system of correlation, maps the information into sound signals which are in turn returned to speakers strategically placed in the original location.

GORDON MONAHAN, SPEAKER SWINGING by Dean Suzuki, is a review of a recent LP by Canadian sound explorer Gordan Monahan, featuring in one piece the sound of speakers swung on 22 foot leads, and in another wind harps with 50- and 100-foot long strings.

And in **Ear** Volume 13 #7, October 1988:

CRASH COURSE: A NOISE HISTORY PRIMER by Neil Strauss is a brief review of noise in music since the turn of the century. Unfortunately, the word "noise" is never defined, and as a result the discussion meanders through various musical styles without clear direction; also, the article contains some misinformation.

ALVIN LUCIER: TALKIN' 'BOUT MY G-G-GENERATIONS is an interview conducted by Larry Birnbaum. Lucier, always thoughtful and thought-provoking, talks about "Chambers," "I am Sitting in a Room," and other pieces arising from a boundless curiousity concerning the nature of sound.

WIRED FOR SOUND by Joe Fodor, in **Omni** (1965 Broadway, New York, NY 10023-5965).

The kinetic sculpture of "engineer-turned artist" Wen Ying Tsai is described briefly but with several photos. Wen Ying Tsai creates exraordinary effects in many cases based upon oscillating behavior in the sonic frequency range. The sculptures respond kinetically to enviromental sound, and the visual effect is enhanced by strobe lights.